Distinguishing Adult and Youth Faces Using Convolutional Neural Networks

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Introduction & Potential Applications

- Objective: Develop a CNN model to distinguish between adult and youth faces.
- Tools Used: TensorFlow, Keras

- Law Enforcement
- Social Media Platforms
- Marketing and Retail

Data Acquisition

The Data: 14,635 images

PLP: 5,423 youth images

POR: 9,212 adult images

Potentially Problematic Data

Data Preparation

Keras `image_dataset_from_directory()`

- Creating training and validation sets
- Addressing class imbalance
- Data Split:
  - 80% Training Set: 11,707 images
  - 20% Validation Set: 2,926 images

CNNs & Computer Vision

- Convolutional Layer
- Pooling Layers
- Regularization
- Loss Function Optimizer

CNN 4 Architecture

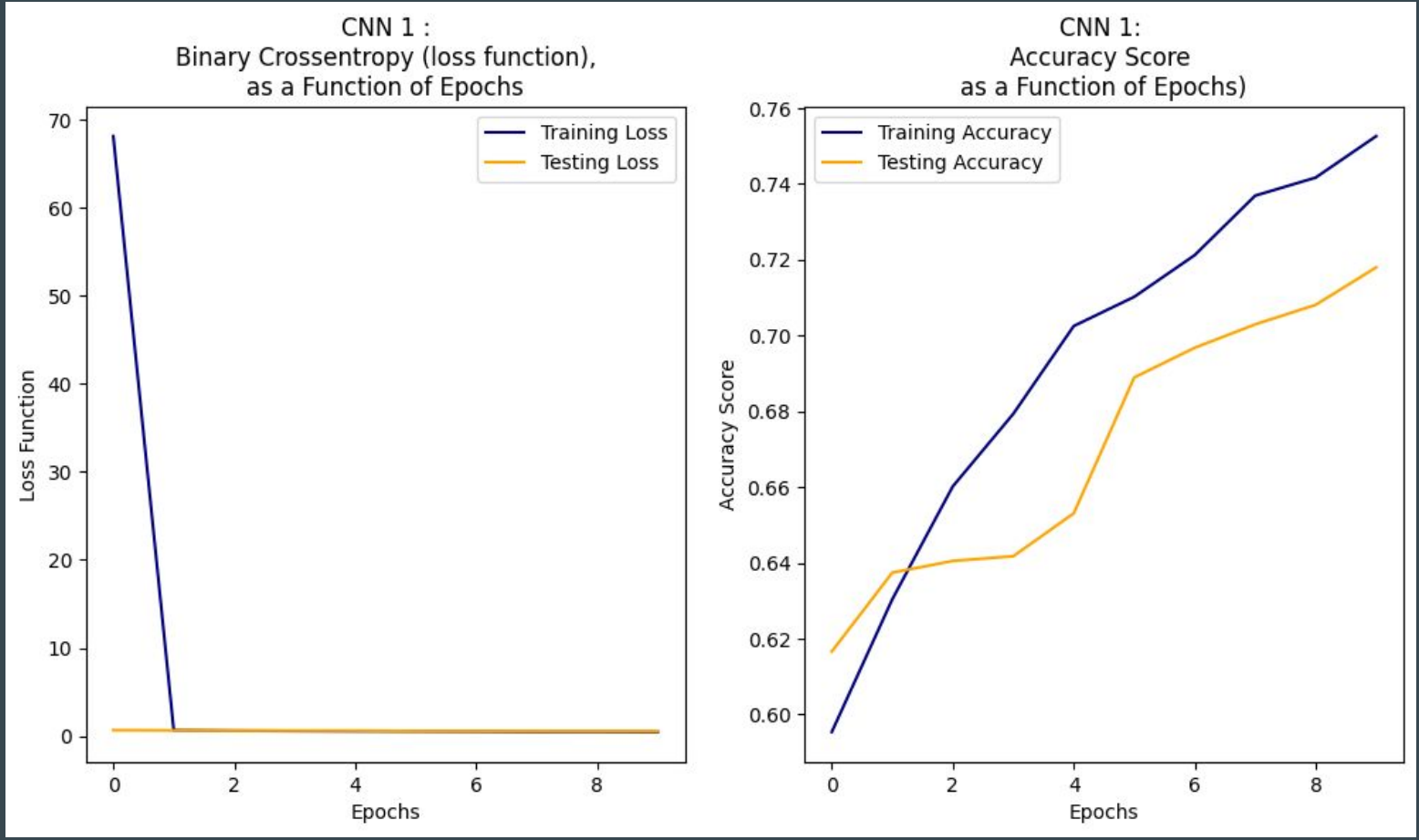
CNN 4: Input Layer + Multiple Hidden Layers with Dropout

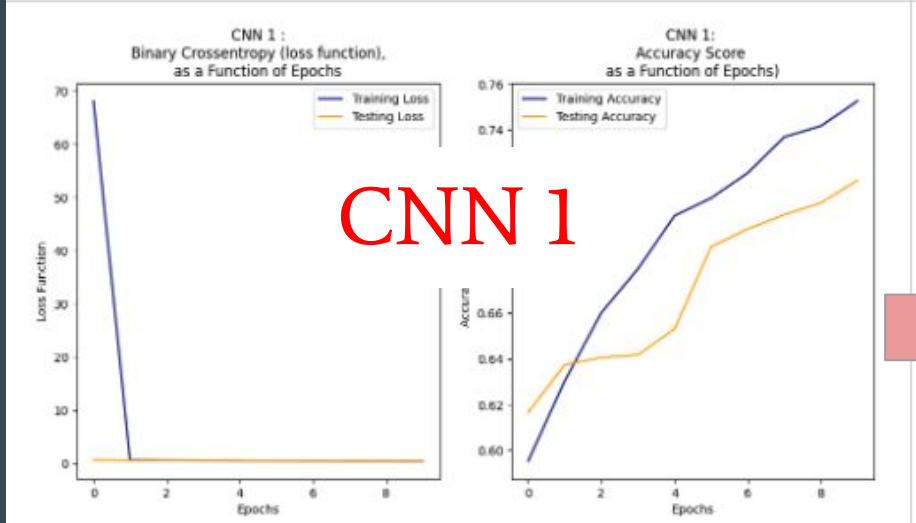
Layer Type	Filters	Kernel Size	Activation	Input Shape	Additional Parameters
Conv2D	512	3	relu	(256, 256, 3)	
MaxPooling2D		2			padding='same'
Dropout					rate=0.5
Conv2D	256	3	relu		kernel_regularizer=regularizers.l2(0.03)
MaxPooling2D		2			padding='same'
Dropout					rate=0.5
Conv2D	256	3	relu		kernel_regularizer=regularizers.l2(0.03)
MaxPooling2D		2			padding='same'
Dropout					rate=0.5
Conv2D	256	3	relu		kernel_regularizer=regularizers.l2(0.03)
MaxPooling2D		2			padding='same'
Dropout					rate=0.5
Flatten					
Dense			sigmoid		Output: 1 neuron

Model Progression

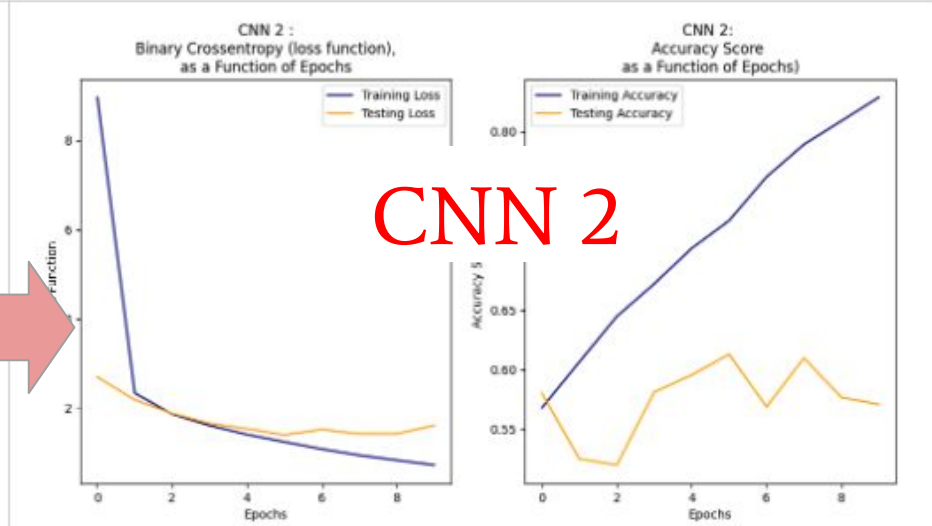
CNN 1	• Good initial performance with a simple architecture. • Lacks complexity to capture intricate patterns.
CNN 2	• Improved accuracy due to additional hidden layers • Overfitting likely due to lack of regularization.
CNN 3	• Regularization (L2, dropout) added; performance decreased, • Regularization may need tuning.
CNN 4	• High dropout reduced overfitting • led to underfitting, causing lower accuracy

CNN1: Loss Function & Accuracy Graphs

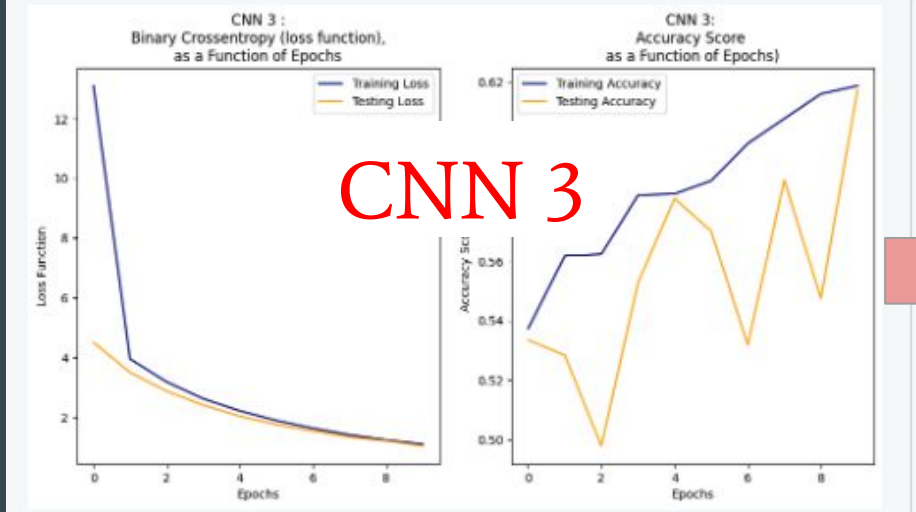




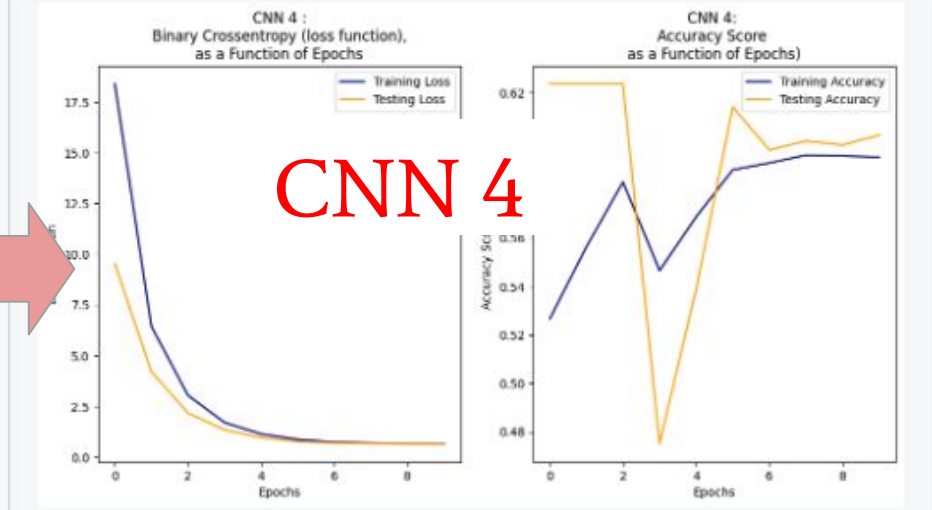
CNN 1



CNN 2



CNN 3



CNN 4

Challenges

- Computational Resources
- Understanding Layers
- Inconsistent Images
- Augmentation vs. weights

Future Work

- Visualizing the images that are being misclassified
- Experimenting with `ResNet`
- Improving the dataset
- Augmenting data
- Explore regularization techniques
- Weed through the images
- Bounding boxes
- Find more computational power

Conclusions

- This project successfully developed and evaluated four CNN models for distinguishing between the faces of adults and youth.

- While the models demonstrated promising initial results, further improvements and optimizations are essential for real-world applications.

- Understanding the reasons behind the models' poor performance provides several key benefits:

Note: an extensive list of sources is available in the README.md file

What Questions Do You Have?